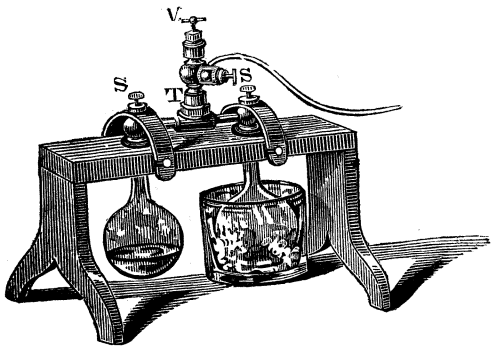
ARTICLE XXV.

Sundry Improvements in Apparatus, or Manipulation. *By R. Hare, M. D., &c., &c., &c.*

IMPROVED CRYOPHORUS.

Two flasks, of which the necks have flanged orifices, are so secured in a wooden frame, that by the pressure of screws S S, and gum-elastic disks, the orifices of a tube are made to form with them severally, air tight junctures. The orifices of the tube are furnished with brass flanges, which correspond with those terminating the necks of the flasks.



Midway between the junctures a female screw is soldered to the tube for the insertion of a valve cock V, by means of which, and a

flexible tube extending to an air pump, the flasks may be exhausted, and then closed. A small quantity of water having been previously introduced into one of them, if, while the exhaustion is sustained, the other flask be refrigerated by ice and salt, the water will be frozen.*

The intelligent chemist will perceive that this apparatus may be applied to the purpose of desiccation by placing the article to be dried in one receptacle, and quick lime, chloride of calcium, or concentrated sulphuric acid, in the other. The orifice of the receptacles may be made larger without inconvenience. Two large cylinders, for instance, may be used.

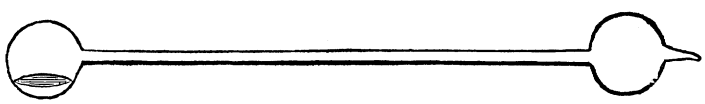
I propose, as soon as I have leisure, to apply the principle illustrated by this apparatus, to the distillation or desiccation of many substances which are liable to injury when exposed to heat, or air. I conceive that there is, by means of analogous apparatus, a fruitful field for improvement in the arts. I conceive that it may be employed in the preservation of meat, milk, fruit, vegetables, and the making of cheese; also in pickling and preserving.†

* For the information of readers who may not be chemists, I subjoin the following explanation of the cause of the congelation of the water.

So long as no condensation is effected, of the thin aqueous vapour, which, when water is present, must occupy the cavity of the instrument, that vapour prevents, by its pressure, or tension, the production of more vapour: but when, by means of cold, the vapour is condensed in one bulb, its evolution in the other, containing the water, being unimpeded, proceeds rapidly. Meanwhile, the water becomes colder, and finally freezes, from losing the caloric which the vaporization requires.

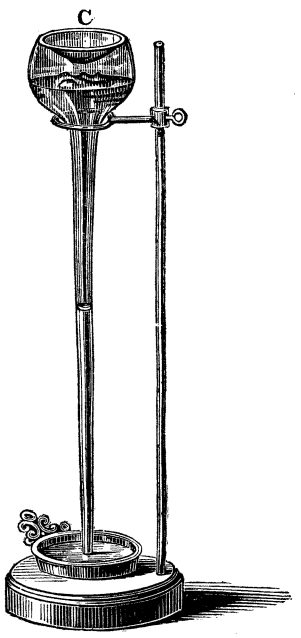
According to Wollaston, one grain of water, converted into vapour, holds as much caloric as would, by its abstraction, reduce thirty-one grains from 60° F. to the freezing point; and the caloric requisite to vaporize four grains more, if abstracted from the residual twenty-seven grains, would convert them into ice.

† This figure represents a very large Cryophorus, the blowing of which I superintended; and by means of which, about twelve years ago, I successfully repeated Wollaston's experiment.



This instrument is about four feet long, and its bulbs are about five inches in diameter.

CULINARY PARADOX, OR EBULLITION BY COLD.



This figure illustrates a new and instructive method of effecting ebullition by cold.

The apparatus consists principally of a glass matrass, with a neck of about three feet in length, tapering to an orifice of about a quarter of an inch in diameter. The bulb is bulged inwards, in the part directly opposite the neck, so as to create a cavity capable of holding any matter which it may be desirable to have situated therein. In addition to the matrass, a receptacle, holding a few pounds of mercury, is requisite. The bulb of the matrass being rather less than half full of water, and this being heated to ebullition, the orifice should be closed by the finger, defended by a piece of gum-elastic, and depressed below the surface of the mercury; the whole being supported as represented in the figure. Under these circumstances, the mercury rises as the temperature of the water declines, indicating the consequent diminution of pressure within the bulb. Meanwhile, the decline of pressure lowering the boiling point of the water, the ebullition continues till the mercury rises in the neck nearly to the height of the mercury in the barometer.

By introducing into the cup formed by the bulging of the bulb, cold water, alcohol, ether or ice, the refrigeration, the diminution of pressure, and the ebullition are all simultaneously accelerated, since these results are reciprocally dependent on each other.

The advantage of this apparatus and method of operating, lies first in the certainty and facility with which the apparatus is secured against the access of the atmosphere; and in the next place, in the index of the diminishing resistance, afforded by the rise of the mercurial column.

HYDRO-PNEUMATIC CISTERN.

Fig. 1. In Silliman's Journal will be found an engraving and description of a pneumatic cistern, which I employed in the experimental illustrations of my lectures for more than ten years; and which I should probably continue to use now, had not the command of water from the public works, put it into my power to dispense with the mechanism for keeping the water at a proper level. As I am now situated, any deficit of water is easily supplied from the pipes known here as the hydrant pipes, by which the city is supplied with water; and any excess is carried off by a waste pipe. Many chemists designate as a pneumatic trough or tub, apparatus for the purposes to which that in question is applied. Neither of these names is, in my opinion, as applicable to the apparatus which I have hitherto used, as that of cistern, to which I resorted; and although the last term be less suitable to the apparatus which I am about to describe, yet I beg leave to adhere to it for want of a better appellation.

A A, a water-tight platform, surrounded by a wooden rim, R R R R, rising above it about an inch and a half. B, C, D, three wells or cavities, each in the form of a hollow parallelopiped, with all of which the cavity bounded by the rim communicates, so that when supplied with water to the level of the waste pipe, this liquid fills the wells, and covers the platform to the depth of about three-fourths of an inch.

E, F, G, shelves, which severally move in grooves over the wells, so that they may be placed in the most convenient position. Under H is a waste pipe. At I is a hydrant pipe. K, a pipe for emptying the wells and casks, with all of which it may be made to communicate by cocks, when requisite. N, O, casks which act as gas holders, each having a communication with the cistern at Q or *q*, for letting in water from that source; the orifices being controlled by valves. By means of a pipe proceeding from its vertex, each gas holder communicates with a pipe or cock, at S or *s*.

To these gallows screws, flexible leaden pipes may be attached, for transferring gas either from one of the holders to a bell glass, or from a bell glass to one of the holders. When a communication is esta-

blished between the cavities, either of these offices may be performed, accordingly as the pressure within the holder is made greater, or less, than that of the atmosphere. It will be greater when the valve for the admission of water is opened, that for letting it out being shut: and less when these circumstances are reversed.

Fig. 1.

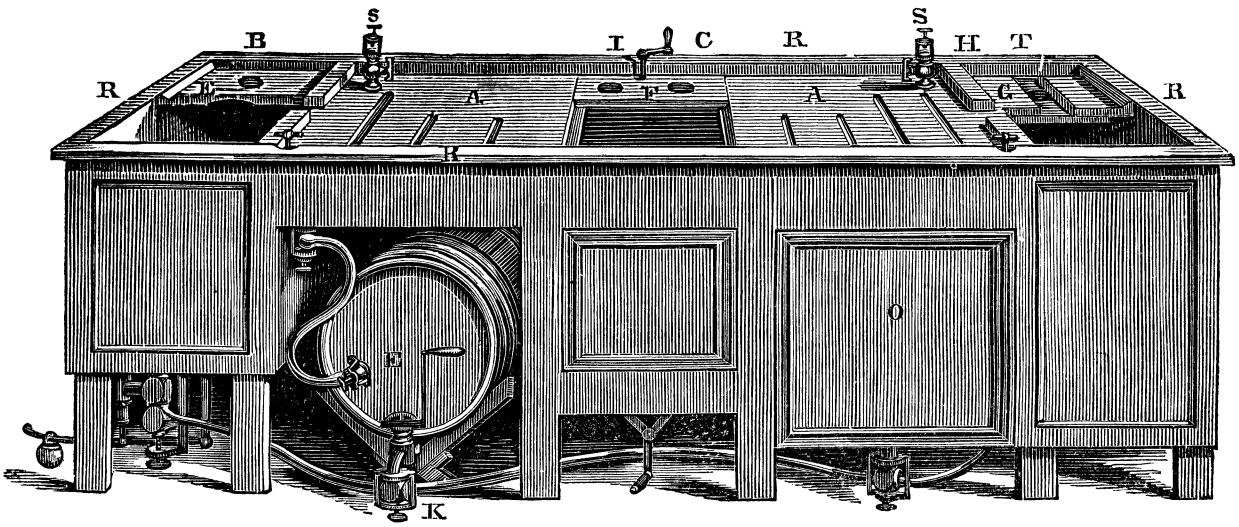
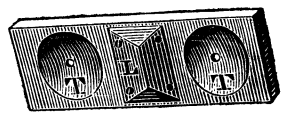


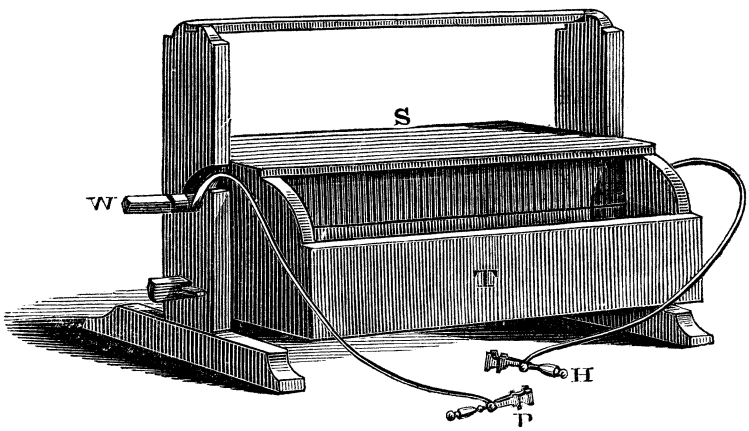
Fig. 2 affords a view of the lower side of the sliding shelf, in the wood of which it will be seen that there are two excavations, converging into holes. This shelf is loaded with an ingot of lead at L, to prevent it from floating in the water of the cistern.

Fig. 2.



ENGRAVING AND DESCRIPTION OF VOLTAIC SERIES, COMBINING THE ADVANTAGES OF THE TROUGH OF CRUICKSHANK WITH THOSE OF THE DEFLAGRATOR.

Fig. 1.

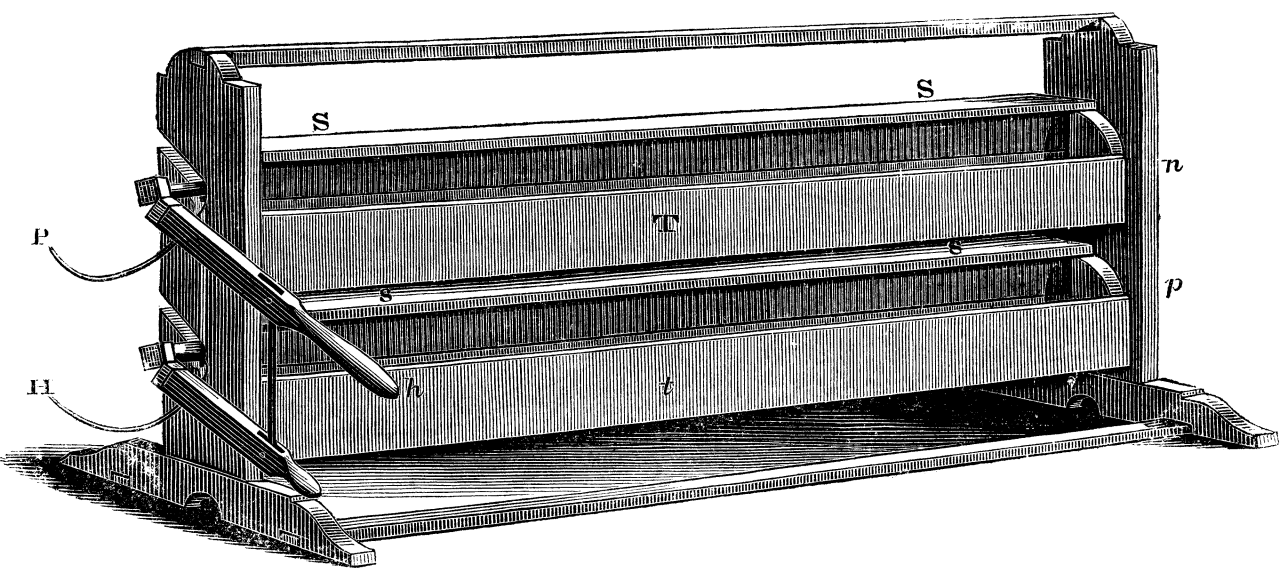


Galvanic Deflagrator of one hundred pairs, of fourteen inches by eight.

Fig. 1 represents a voltaic series, upon the plan of the trough of Cruickshank, associated with another trough destitute of plates, and of a capacity sufficient to hold all the acid necessary for an ample charge. The trough containing the series is joined to the other lengthwise, edge to edge, so that when the sides of the one are vertical, those of the other must be horizontal. The advantage of this arrangement is, that by a partial revolution of the two troughs, thus united, upon pivots which support them at the ends, any fluid which may be in one trough must flow into the other; and, reversing the movement, must flow back again. The galvanic series being placed in one of the troughs, the acid in the other, by a movement such as above described, the plates may all be instantaneously subjected to the acid, or relieved from it. The pivots are made of iron, coated with brass or copper, as less liable to oxidizement. A metallic communication is made between the coating of the pivots, and the galvanic series within. In order to produce a connexion between one recipient of this description and another, it is only necessary to allow a pivot of

each trough to revolve on one of the two ends of a strap of sheet copper. To connect with the termination of the series, the leaden rods, to which are soldered the vices, or spring forceps, for holding the substances to be exposed to the deflagrating power, one end of each of the lead rods is soldered to a piece of sheet copper. The pieces of copper, thus soldered to the lead rods, are then to be placed under the pivots, which are of course to be connected with the termination of the series. The last mentioned connexion is conveniently made by means of straps of copper, severally soldered to the pivots and the poles of the series, and screwed together by a hand-vice. Each pair consists of a copper and a zinc plate, soldered together at the upper edge, where the copper is made to embrace the edge of the zinc. The three remaining edges are made to enter a groove in the wood, being secured therein by cement. For each inch in the length of the trough there are three pairs. In the series represented by Fig. 1, there are seven hundred pairs of seven inches by three; in that represented by Fig. 2, one hundred pairs of fourteen inches by eight. The latter will deflagrate wires too large to be ignited by the other, but is less powerful in producing a jet of flame between the charcoal points, or in giving a shock.

Fig. 2.



Galvanic Deflagrator of seven hundred pairs, of seven inches by three.

Fig. 2, on the foregoing page, represents a series which comprises two Cruickshank deflagrators, so constructed as to co-operate in one circuit by an adequate communication between their poles, and being so associated with a lever, as to be made, by means of it, to revolve simultaneously. They may be made to act either collaterally, as a series of 350 pairs, or consecutively, as 700. As the plates are seven inches by three, when used collaterally, they are equivalent to 350 plates of seven inches by six.

COMBUSTION OF PHOSPHORUS IN NITROUS OXIDE GAS.

There is a striking backwardness in the oxides of nitrogen to part with their oxygen to phosphorus, until it be intensely ignited, either by an incandescent iron, or by the access of uncombined oxygen.

This characteristic in the case of nitrous oxide, may be illustrated by means of an apparatus like that employed for the combustion of phosphorus in oxygen* with a tall cylindrical receiver, and a tube descending through the neck, and along the axis of the receiver, terminating in a capillary orifice over the cup for holding the phosphorus. The upper end of the tube, outside the receiver, is furnished with a cock, to which a gum-elastic bag inflated with oxygen is attached.

Under these circumstances, the receiver having been exhausted, and filled with nitrous oxide; phosphorus, previously placed within the cup, may be melted without taking fire. But as soon as the cock communicating with the bag of oxygen is opened, an intense combustion ensues; since the oxygen, emitted in a jet from the capillary orifice of the tube, reaching the melted phosphorus excites it into an active combustion, which the nitrous oxide afterwards sustains with great energy.

* See article on Forcing Air Pump, page 388.

COMBUSTION OF PHOSPHORUS IN NITROUS OXIDE.